THE ONTARIO POWER CO. OF
NIAGARA FALLS AND THE ONTARIO
TRANSMISSION COMPANY, LTD.

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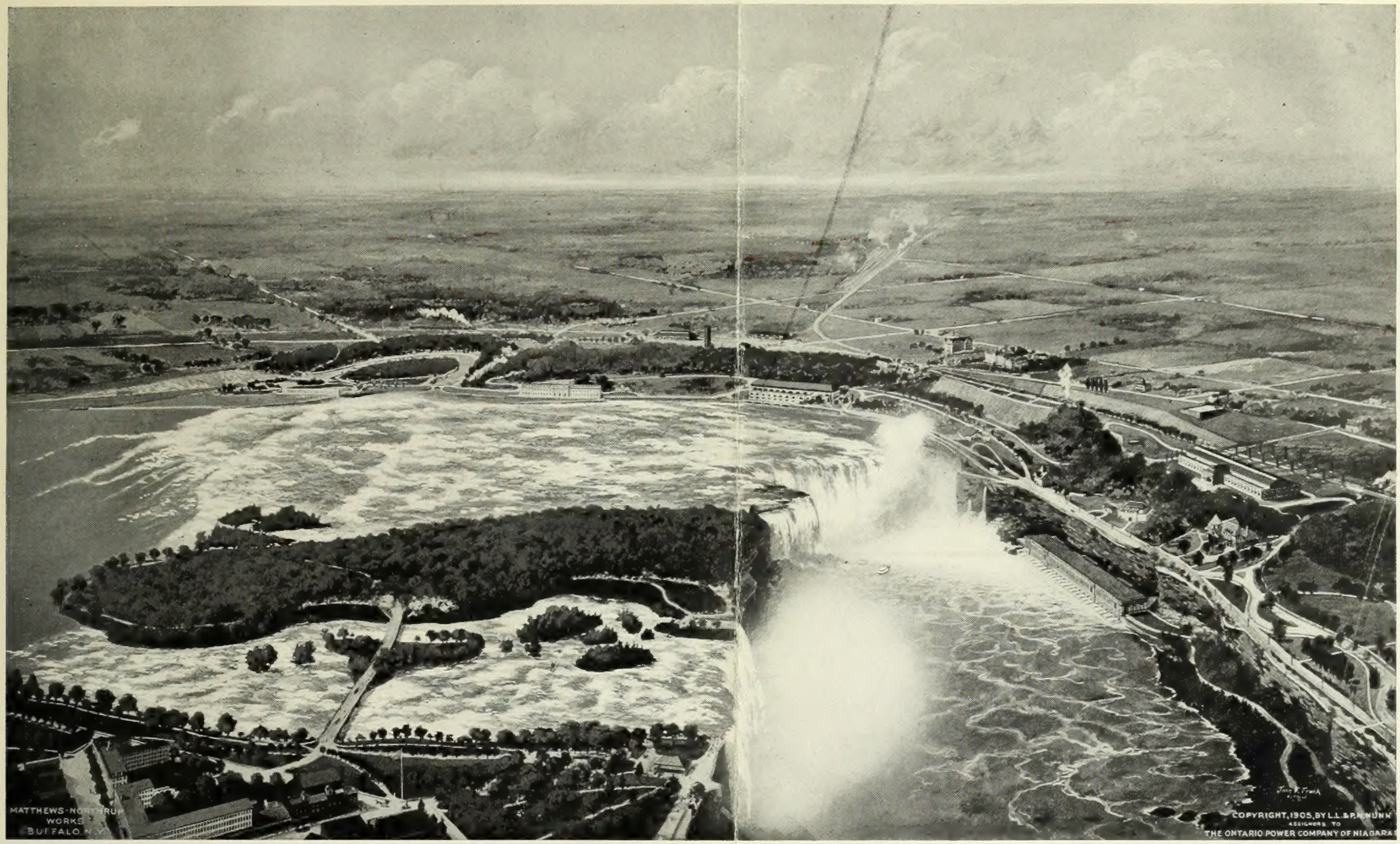
THE ONTARIO POWER COMPANY OF NIAGARA FALLS
NIAGARA, LOCKPORT AND ONTARIO POWER COMPANY

I SHALL scarcely exaggerate in describing the combined systems of the above two Companies as the most important hydro-electric power concern in the world. This title, however, is fully justified by reason of, first, the very large amount of power generated; second, the remarkable source of the power; and, third, the enormous territory served by the Companies.

(Extract from "THE STATIST" of February 8, 1913.)

VISITORS are admitted to the plant, accompanied by a guide, between the hours of 9.00 A. M. and 5.00 P. M. For this privilege a nominal charge is made, part of which is used to pay for the services of guides, and the remainder applied to the support of a bed in the Niagara Falls General Hospital.

Certain portions of the plant are inaccessible to visitors, due to the extremely high voltage used, and also from the danger of allowing their presence to interfere with its efficient operation.



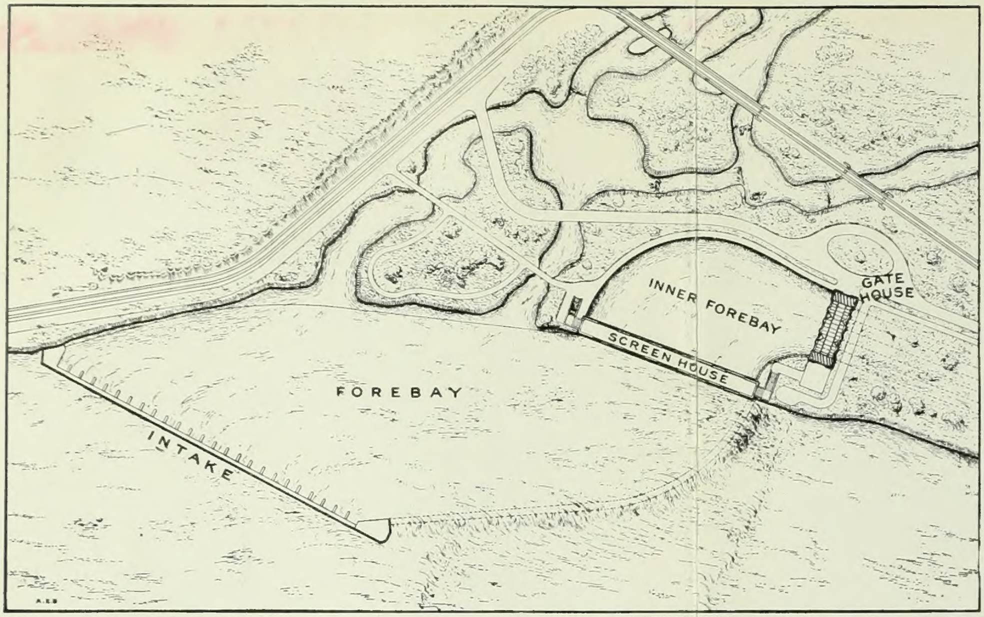
BIRD'S-EYE VIEW OF NIAGARA FALLS SHOWING POWER DEVELOPMENT ON CANADIAN SIDE

THE falls of Niagara have long been recognized as a possible source of immense power, and, in fact, were utilized in a small way by the early settlers of the district. They, however, were unable to utilize the main falls and so confined their operations to the rapids. Here they built saw mills and grist mills and thus took the first steps in the harnessing of Niagara.

Modern conditions, with the wonderfully flexible means of distributing and utilizing large amounts of energy, embodied in the use of electricity, call for methods of development far different from those used by the early settlers. In place of the small amount of power needed for grinding corn or sawing logs, there are now required thousands of horse power for the performance of a myriad of tasks. The few feet of head which satisfied the settlers' needs must now be increased to the maximum possible to obtain. In place of the breast or overshot wheel we now have the highly efficient modern turbine.

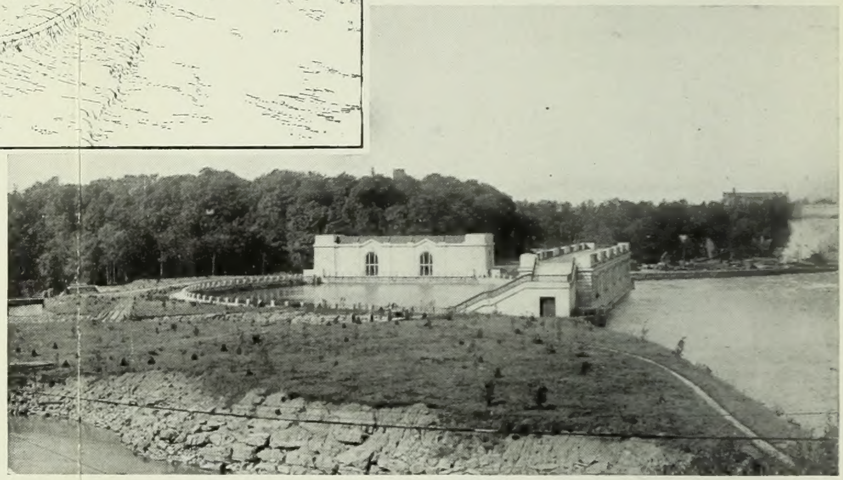
Among these modern power plants which are everywhere thus beginning to make efficient use of the energy supplied by nature in the form of falling water, that of The Ontario Power Company of Niagara Falls is one of the most recent, and the largest.

The general plan of the Company's development is as follows: Water is taken from the river at a point on the Canadian shore about a mile above the crest of the Horseshoe Fall, and just above the rim of the first cascade of the upper rapids. After being thoroughly freed from floating ice and debris, it is conveyed, through steel and concrete conduits laid underground and steel penstocks tunneled through the solid rock, to the Generating Station situated at the base of the cliff below the Horseshoe

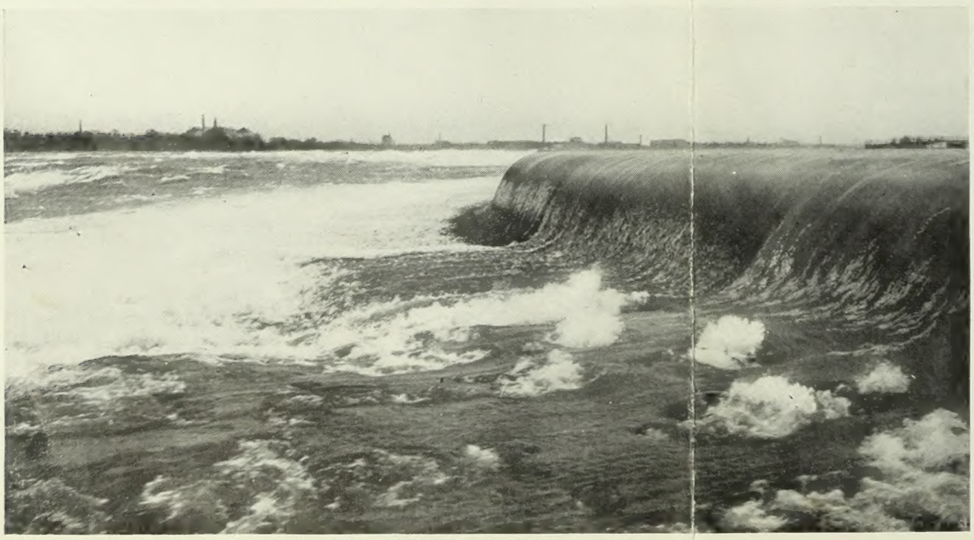


PLAN OF INTAKE WORKS

Fall. The electrical energy here generated by means of turbines and generators is transmitted by underground cables to the Distributing Station located high on the bluff above. From this station radiate the transmission lines which convey the power to the manifold enterprises depending upon it. In the winter and spring large quantities of ice come down the river, floating on the surface for the most part but with enough suspended in the water to impede the successful operation of the plant, were it not removed at the head-works. For this purpose a long intake dam stretches out into the river in a down-stream direction, almost parallel to the current, admitting to the forebay only the water at the bottom of the river, while ice and floating debris are carried to the rapids by the swift current that sweeps along its outer face. In the comparative quiet of the outer forebay more ice rises to the surface to be similarly skimmed off at the screen house, where the water is further cleansed by heavy iron screens. At the gate house the water is again skimmed and finally admitted to the main conduits through large electrically operated gates. The design of these intake- or head-works is as unique as their operation is successful. During the eight winters that they have been in operation there has not been a moment's interruption from ice — a record which is unprecedented for power plants in a climate like that of Niagara. The gate house contains the gates, electrically operated, which regulate the flow of water from the inner forebay to the conduits. One of the gates was completed in 1905, the second in 1910, and one more will



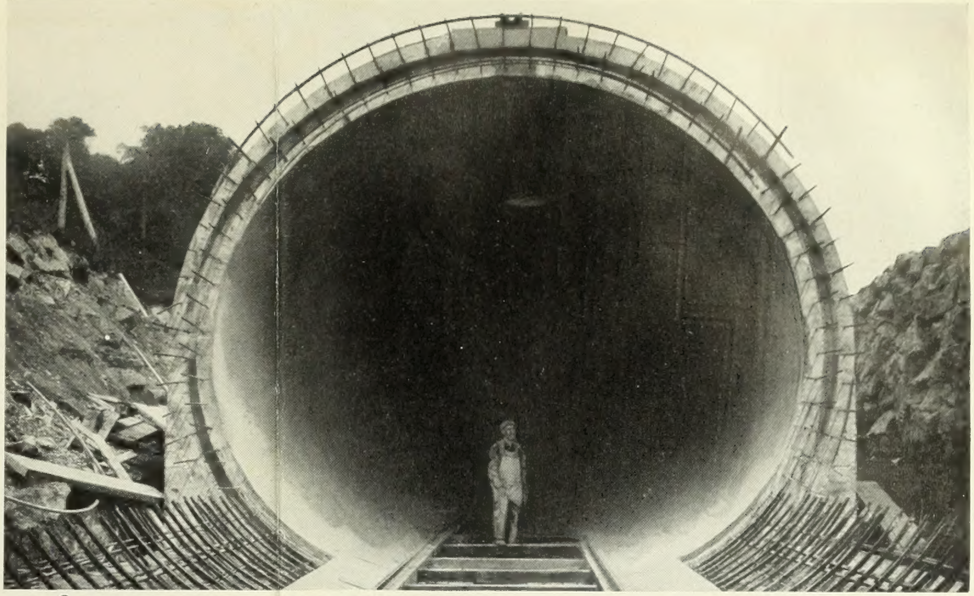
FOREBAYS, SCREEN HOUSE, AND GATE HOUSE



RETURN OF WATER TO RIVER OVER SUBMERGED WALL

be required for the complete development.

From the gate house two 18-foot diameter steel and concrete conduits lead the water underground through Queen Victoria Park for a mile, the first conduit terminating at the overflow and the second at the surge tank. The purpose of the overflow and surge tank is to prevent undue rise of pressure in the conduits in case of a sudden decrease in the amount of water required for power, the surge tank also serving to provide water for an increase in power while the water in the conduits is accelerating.



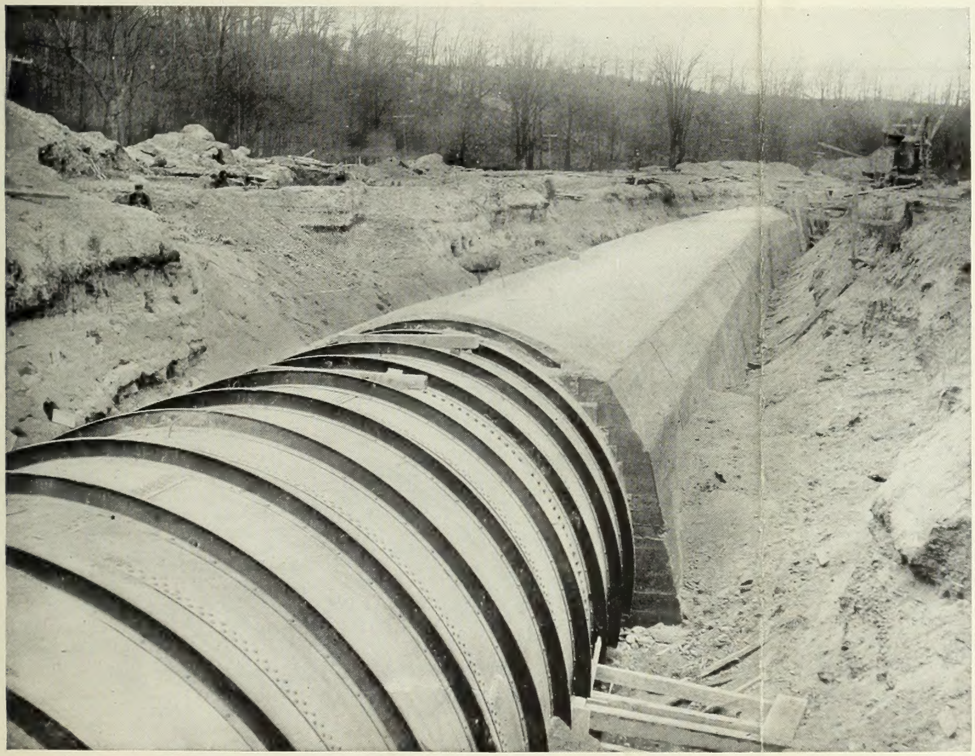
NO. 2 MAIN CONDUIT DURING CONSTRUCTION

Adjacent to the overflow and surge tank, steel penstocks, nine feet in diameter, lead downward from the conduits through electrically-operated valves located in a room hollowed out of the rock, to a level slightly below that of the Generating Station floor, then extend horizontally to the turbines. Each penstock supplies one turbine unit.

From the turbines, the water is discharged through draft tubes, and returns to the river under the outer wall of the Generating Station.

At present, twelve generators are installed, with a total capacity of 143,000 horse power, all being of the horizontal-shaft type and directly connected to the balanced twin turbines. Two 1,600 horse power turbine-driven, alternating current dynamos furnish power for individual motor-generators which supply the exciting current for the large machines.

Cable tunnels and conduit systems lead from the Generating Station to the Distributing Station on the hill. The electrical power is thus conducted in lead-covered cables to the bus-bars. From the bus-bars, a part of the power is distributed through cables to the transformers, where the voltage is stepped up from 12,000 to 60,000 volts. At this voltage it is sent out on the lines, some of it going as far as Syracuse, N. Y., one hundred and sixty miles away. The power for use in Canada is sent out at 12,000 and 30,000 volts, to the many industries in the vicinity of the plant and along the Welland Canal, and to the system of the Hydro-Electric Power Commission of the

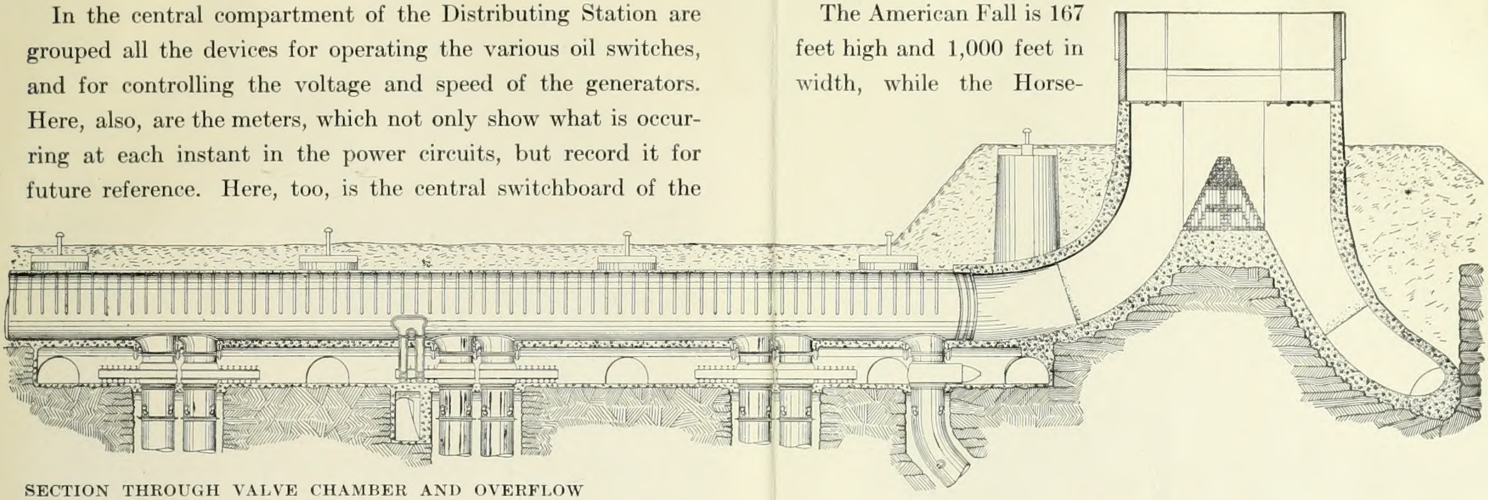


NO. 1 MAIN CONDUIT DURING CONSTRUCTION

NIAGARA FALLS AND IMMEDIATE VICINITY.

Province of Ontario for transformation and distribution at 110,000 volts.

In the central compartment of the Distributing Station are grouped all the devices for operating the various oil switches, and for controlling the voltage and speed of the generators. Here, also, are the meters, which not only show what is occurring at each instant in the power circuits, but record it for future reference. Here, too, is the central switchboard of the



SECTION THROUGH VALVE CHAMBER AND OVERFLOW

private telephone system, over which it takes but an instant to call up any station on the network of power lines. This system of central control is original with this plant, and, like the scheme for diverting ice at the intake works, is as successful as it is unique.

Throughout the Company's works no pains have been spared to preserve the beauty of the Park and the integrity of the Falls. The intake is so located and constructed as to raise rather than lower the level of the upper river. Screen and gate houses have been carefully designed to befit their location. New islands have been created and new vantage points provided for viewing the falls and rapids, all of which are perfectly free and open to the public use. All unsightly constructions, which, by their nature, could not be made beautiful, have been placed out of sight underground. The Generating Station so blends itself into its background as to be almost unnoticeable. The Distributing Station, from its location necessarily a conspicuous object, has been treated with the dignity to which its position entitles it. Altogether, it may be stated that the Company has expended close to a million dollars in this work, from which it receives no return but the approval of the visiting public.

THE PLANT IN DETAIL

FALLS AND RIVER

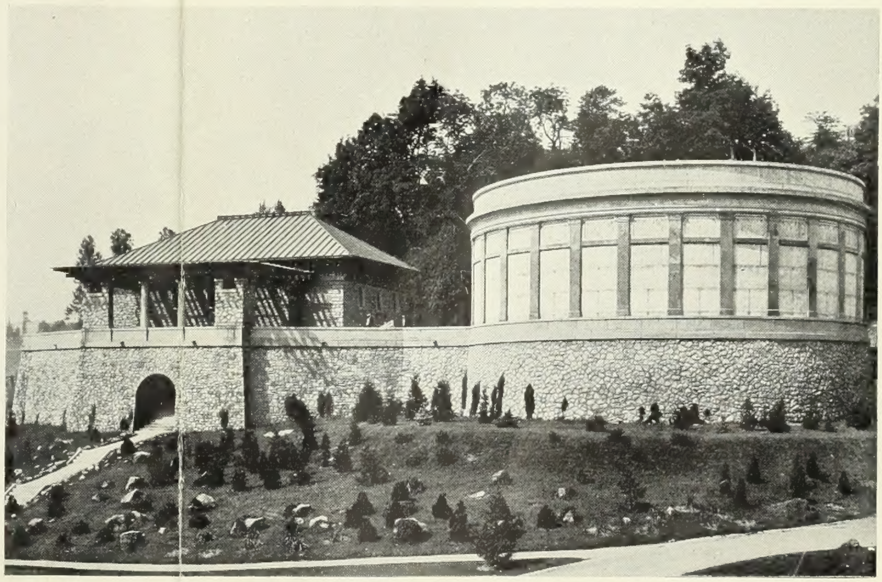
The total drop in the Niagara River in its course of 36 miles between Lake Erie and Lake Ontario is 326 feet, of which 216 feet is in the falls and the rapids immediately above them.

The American Fall is 167 feet high and 1,000 feet in width, while the Horseshoe Fall is 159 feet high and 2,600 feet in width. The greatest depth of the river immediately below the falls is about 192 feet.

It is estimated that an average of 222,400 cubic feet of water pass over the falls each second. This is 25,000,000 tons an hour, or about one cubic mile a week, and represents a kinetic energy of nearly 5,000,000 horse power.

HEADWORKS

At the headworks of The Ontario Power Company the river is 3,400 feet wide, and flowing at an average velocity of about 8 feet per second.



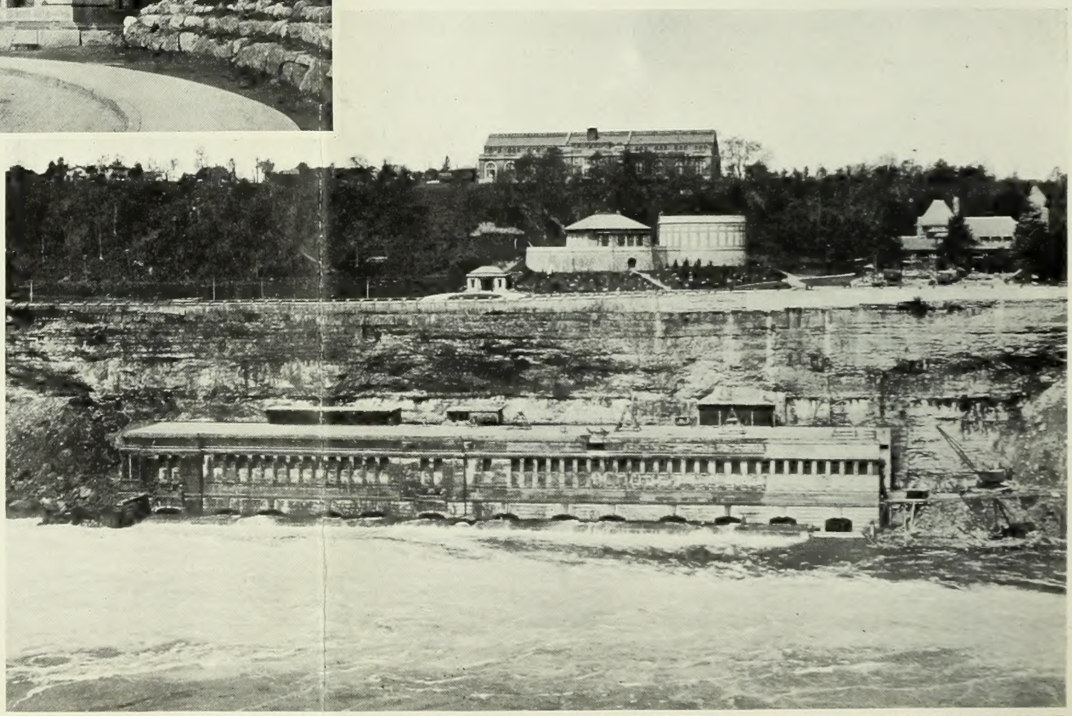
OVERFLOW AND SURGE TANK

THE INTAKE, constructed of reinforced concrete, is nearly 600 feet long, and is divided into twenty-five bays. The concrete curtain, which deflects the surface current, extends 9 feet into the water, which is here 15 feet deep. Through these bays or openings in the intake water is admitted to the outer forebay, with an entering velocity of 5 feet per second. Provision is made for inserting stop logs into each of the twenty-five openings in order to regulate the flow of water.

THE OUTER FOREBAY, having an area of 8 acres and a depth ranging from 15 to 20 feet, is bounded on its down-stream side by a submerged wall or dam, over which a large part of the water which enters the forebay is returned to the upper rapids, bearing with it such ice and debris as succeed in passing the intake curtain. This wall is 725 feet long and terminates at the down-stream end of the screen house.

ENTRANCE BUILDING

THE SCREEN HOUSE is 320 feet long, built of reinforced concrete faced with "Roman Stone." Broad, ornamental stairways at either end lead to the roof, where a spacious promenade, open to the public at all times, commands a magnificent view of the upper rapids. The water at the screen house is 20 feet deep. A five-foot concrete curtain wall again admits only deep water through the screens to the inner forebay.



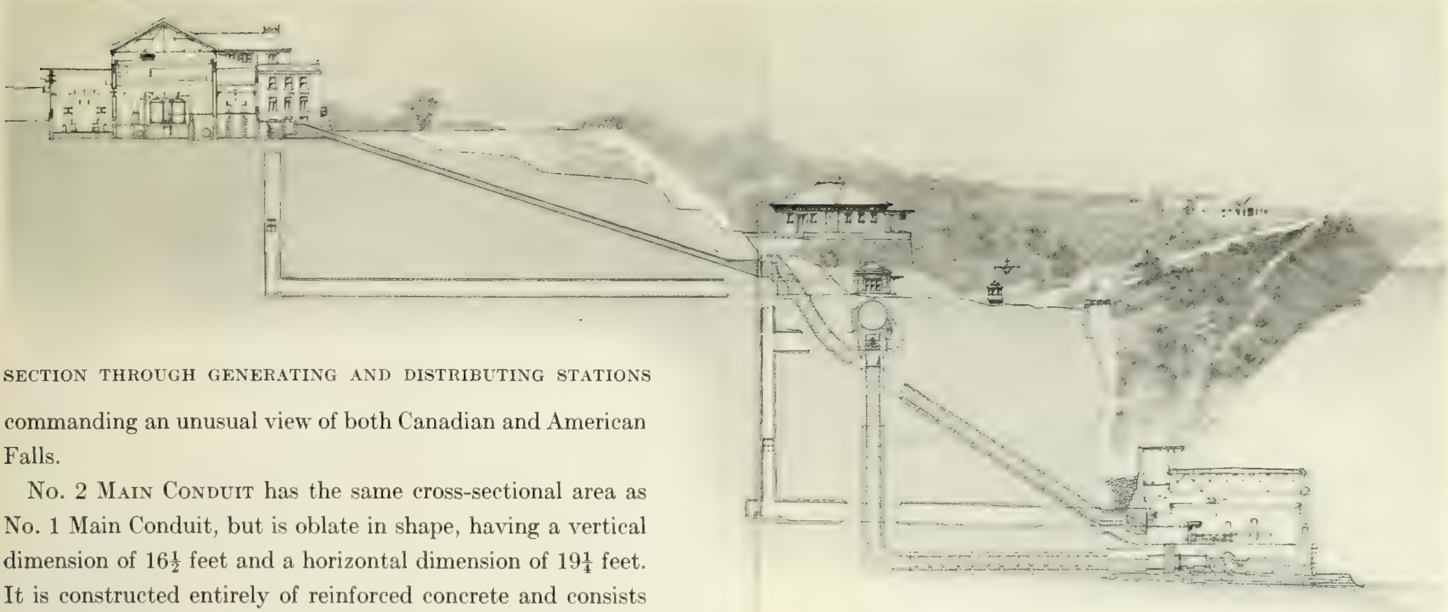
GENERATING STATION, OVERFLOW, SURGE TANK, AND DISTRIBUTING STATION AS SEEN FROM GOAT ISLAND

THE INNER FOREBAY forms a quiet pool of 2 acres area and 20 to 30 feet depth, where the water has a final opportunity for being cleared of foreign matter, before entering the conduits.

THE GATE HOUSE, similar in construction to the screen house, is 120 feet long and divided into six bays, two for each main conduit. The entrances to the conduits are guarded by "Stoney" gates, 18-foot and 20-foot respectively, weighing about 40 tons each, including the counterbalances. The gates were built by Ransomes & Rapier of London, England, and are operated by electric motors.

CONDUITS AND PENSTOCKS

No. 1 MAIN CONDUIT is 18 feet in diameter, 6,300 feet long, 254 square feet in cross-sectional area, and is made of half-inch steel plates with stiffening rings half way round the top at intervals of 4 feet throughout its length. It is entirely encased in concrete, and covered to a depth of from 4 to 10 feet with earth and rock backfill. It terminates in a massive overflow structure of reinforced concrete, containing an adjustable weir of stop-logs, over which the surplus water is discharged through a spiral tunnel to the lower river. The building is finished with a facing of rubble stone, and has a broad promenade



SECTION THROUGH GENERATING AND DISTRIBUTING STATIONS

commanding an unusual view of both Canadian and American Falls.

No. 2 Main Conduit has the same cross-sectional area as No. 1 Main Conduit, but is oblate in shape, having a vertical dimension of 16½ feet and a horizontal dimension of 19¼ feet. It is constructed entirely of reinforced concrete and consists of a shell 18 inches in thickness supported by a continuous concrete saddle. This conduit terminates in a reinforced concrete cylindrical surge tank, 75 feet in diameter. The water from the conduit has access to the tank by flowing over the top of a vertical riser 60 feet in height, and also through a large opening or port at the bottom. The surge tank accomplishes the double purpose of storing excess water when the load on turbines is reduced, and of supplying water to the turbines for an increase in load while the water in the conduit is accelerating. This manner of regulation is most efficient, as no water is wasted and all that enters the conduit from the forebay is conserved. The surge tank also permits of shutting off any waste water from the overflow of No. 1 Main Conduit and still maintaining adequate regulation.

Valve Chambers are built beneath the lower ends of the main conduits. These chambers are approximately 300 feet long, 10 feet high, and 16 feet wide, and have arched concrete roofs to support the conduits above. Large tapered cast and plate steel intakes lead down from the conduits to the 9-foot valves here located.

The first six valves were built by Ransomes & Rapier, and are intended to withstand pressure from above only; the two valves for the seventh unit were built by Pratt & Cady of Hartford, Conn., to withstand pressure on either side, as they admit water to this unit from either No. 1 or No. 2 Conduit. The valves for units 8 to 12 were built by the Chapman Valve Manufacturing Company of Springfield, Mass., and, like the first six, are designed to withstand pressure from above only. Each valve is operated by a 30-horse power induction motor, and may be fully opened or closed in about 5 minutes. The two 4-foot valves for the main exciter units are of the recently developed Johnson type. They require no motors, gears, or hydraulic cylinders for their operation, the actuating force being the water pressure itself within the valve body. These have proved so satisfactory that similar valves, 9 feet in diameter, will be used for the thirteenth and fourteenth main generating units, now in course of installation.

The Penstocks are carried through tunnels and shafts excavated in the rock cliff behind the Generating Station. They are of 9 feet inside diameter and vary from 225 to 307 feet in length. They are built of steel plates increasing from ⅜-inch thick at the top to ⅞-inch at the bottom.

GENERATING STATION

The mean water level here is 343 feet above tide, though it varies from 338 to 365. The walls of the Generating Station are of concrete, the rear wall being 12 feet thick at the bottom, and the river wall, 9 feet.

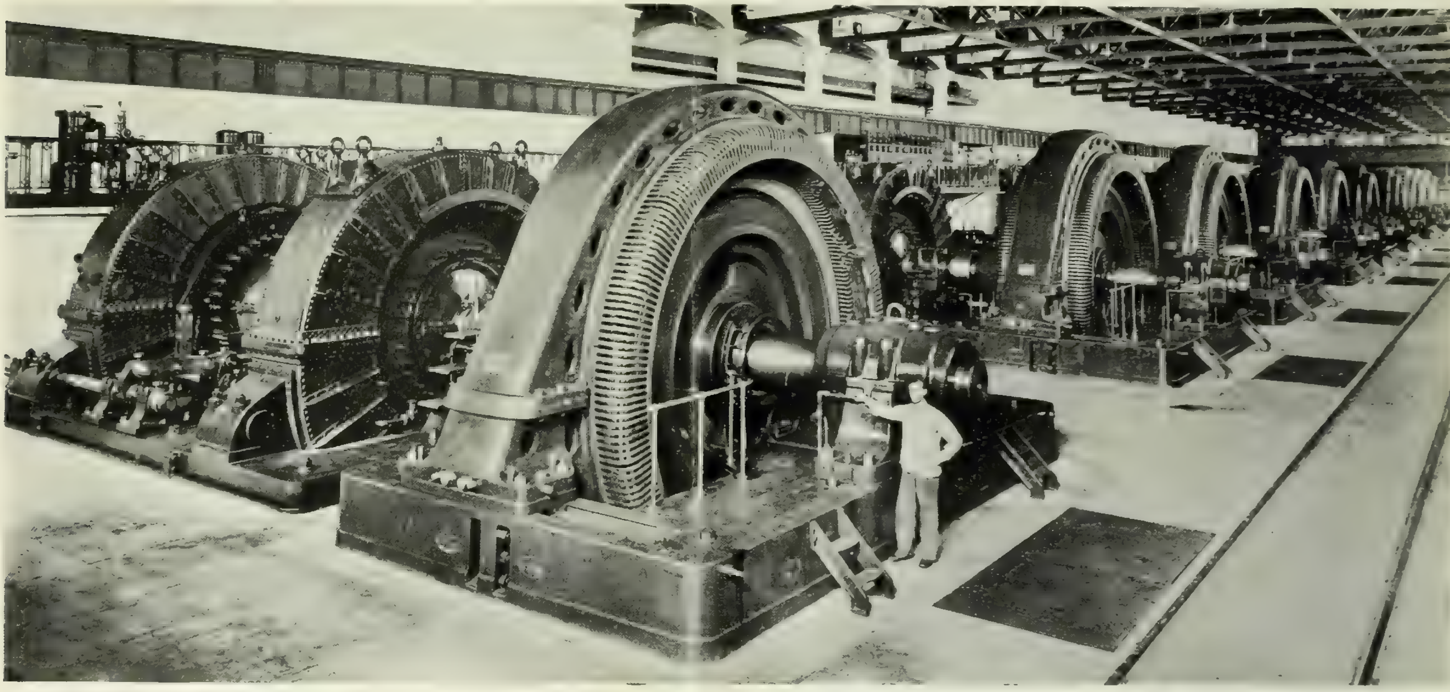
The Turbines are of the inward-flow horizontal twin type, eleven manufactured by J. M. Voith, Heidenheim a. d. Brenz, Germany, and the twelfth by the Wellman-Seaver-Morgan Company, Cleveland, Ohio. Seven are of 12,500 and five of 13,400 horse power capacity each, operating under the normal effective head.

POWER DISTRICT

F NIAGARA FALLS.

The Generators have the following characteristics: Speed, 187½ revolutions per minute, 3 phase, 25 cycles, 12,000 volts. Three are of 10,000, four of 12,000, and five of 13,000 electrical horse-power capacity each. Seven were built by the Westinghouse Electric & Manufacturing Company, of Pittsburgh, Pa., and five by the Canadian General Electric Company, Limited, of Peterboro, Ont.

The Governors. Four were made by the Lombard Governor Company of Ashland, Mass., and eight by J. M. Voith. All operate by means of oil under pressure.



INTERIOR OF GENERATING STATION

The Main Exciter Plant comprises two units, each consisting of a 1,600 horse-power turbine; a 900 K. W., 2,200-volt, 3 phase, 25 cycle, 375 r. p. m. A. C. Generator; a special 2,200-volt Induction Motor, and a 25 K. W., 125-volt Direct Current Generator, mounted on a single shaft. They were built by Allis-Chalmers-Bullock, Limited, Montreal, Quebec. These units are located in a Central Exciter Bay, the floor of which is elevated seven feet above the main floor. The turbines are supplied with water through 4-foot penstocks which connect with No. 2 Main Conduit through one of the cable tunnels. The function of the special induction motors is to drive the 2,200-volt generators in case of accident to the turbines, thus minimizing the possibility of failure of the exciting current. Each exciter unit is of sufficient capacity to supply current for driving all the individual motor-generator exciter sets, one of which supplies each of the 12,000-volt generators.

The Individual Exciter Sets, one for each 12,000-volt generator, are driven by the independent supply of current from the main exciter plant. Each consists of a 60–75 horse power, 2,200-volt, 750 r. p. m., induction motor, and a 40–60 K. W., 200-volt, direct current generator, located in the gallery adjacent to the 12,000-volt unit which it supplies.

INTERSTATION

The Cable Tunnels lead from the Generating Station to manholes just above the main conduit. Each is 285 feet in length and inclined at an angle of about 30 degrees from the horizontal. The side walls of the tunnels contain tile ducts which carry the 12,000-volt, three-conductor power cables, two for each generator. The control, low voltage, and service wiring is carried in iron ducts suspended from or built into the roof. From the upper ends of these tunnels to the Distributing Station, a distance of 320 feet, the cables are carried in standard underground conduits.

DISTRIBUTING STATION

This building, of red brick with limestone trimmings, occupies a commanding position on the bluff overlooking the Gorge and

Cataract. It is absolutely fireproof in construction, and contains, in addition to its electrical equipment, the offices of the Company.

The 12,000-Volt Bus Structure is of the semi-enclosed form, built entirely of reinforced concrete. After leaving the three-conductor cables, each wire of the system is carried in a separate compartment, isolated from every other.

The Oil Switches for controlling the 12,000-volt circuits are arranged in groups corresponding to the generating units, and are operated electrically from the Control Room.

DISTRIBUTING STATION, OWNED JOINTLY, THREE-FOURTHS BY ONTARIO TRANSMISSION COMPANY, ONE-FOURTH BY ONTARIO POWER COMPANY

The Transformers are of 3,000 K. W. capacity, 12,000 to 60,000 volts, oil insulated and water cooled. They are grouped in threes, each group being separated from the others by a fireproof wall. Each transformer is enclosed in a steel tank capable of withstanding an internal pressure of 150 pounds per square inch and immersed in 70 barrels of oil. The normal capacity of the eighteen transformers installed is 72,000 horse power, with overload capacity of 25 per cent.

The High-Tension Bus is of the open type of construction and is in a separate compartment away from other apparatus. Circuits leading to and from this bus are controlled by electrically-operated oil switches.

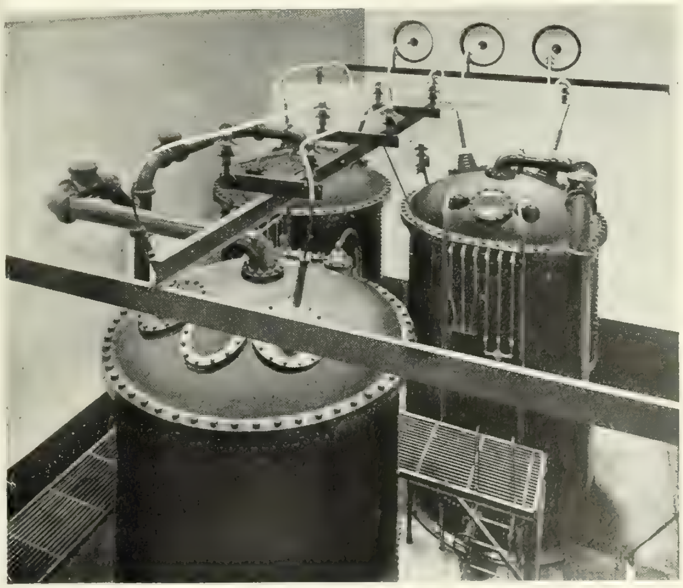
The Low-Tension Feeder Bus, corresponding in position and use with the High-Tension Bus, is fed from the Main 12,000-volt bus and feeds, through electrically-operated oil switches, the low-tension transmission lines. This construction enables each of the latter to be separately controlled, resulting in maximum reliability of service.

The Control Room is a spacious apartment located high up in the center of the building, where all disturbance is reduced to a minimum and highest efficiency of operation may be had. It contains the control pedestals and indicating instrument stands corresponding to the generating and transforming units, feeder switchboards, alternating- and direct-current service switchboards, voltage regulators, and telephone switchboard. It is connected, through fireproof doors, with the other compartments of the building containing the switches, transformers, busses, etc.

On a mezzanine floor below the Control Room are located all the recording and integrating instruments, for measuring the output of the station. On a still lower floor are relays for automatically opening the circuits in case of trouble, and the fuse and terminal boards, for the control and instrument wires.

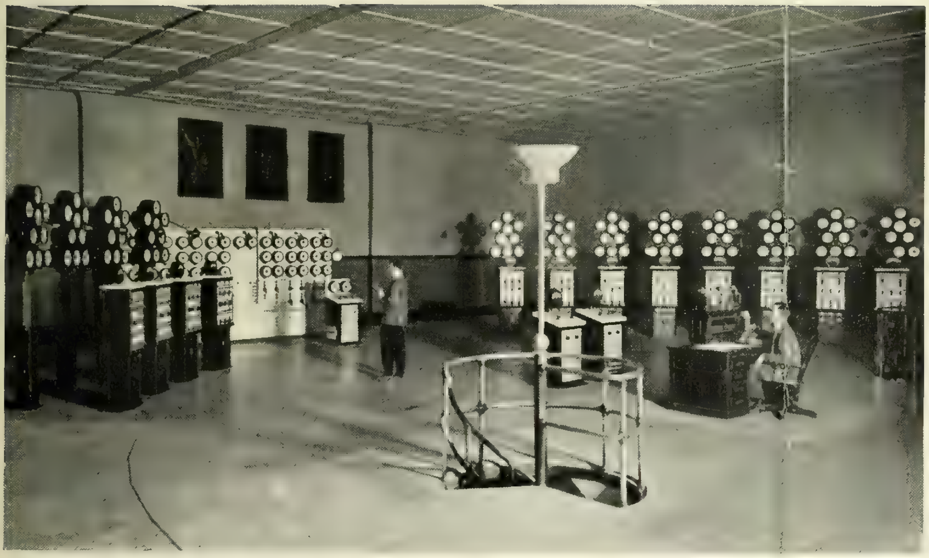
Lightning Protection is obtained on the 60,000-volt lines by means of electrolytic lightning arresters, mounted outside of the station, and choke coils between the transformers and the high-tension bus. Horn-gap arresters are also installed.

On the 12,000-volt lines this protection is obtained with the same type of lightning arresters, but mounted inside the building in an isolated compartment especially provided for them. Choke coils are also installed in each circuit between the line and the feeder bus.



VIEW IN TRANSFORMER ROOM

NIAGARA FRONTIER, SHOWING LOCATION OF PLANT OF THE ONTARIO POWER CO., ALSO THE TRANSMISSION LINES.



CONTROL ROOM IN DISTRIBUTING STATION

TRANSMISSION LINES

Two 60,000-Volt Lines run from the Distributing Station six miles to a point on the Niagara River near the town of Queenston, where they cross the Gorge and connect with the lines of the Niagara, Lockport and Ontario Power Company, delivering power for use in the United States. These lines consist of aluminum conductors 1⅛ inches in diameter, carried on steel towers 55 feet high to the top wire, with an average span of 500 feet. The insulators for this line are of porcelain and weigh 35 pounds each.

12,000 and 30,000-Volt Lines are used for local distribution in Canada and are carried on wooden poles. Power from these lines is now being delivered in Niagara Falls, Thorold, Merritton, St. Catharines, Chippawa, Port Robinson, Welland, Humberstone, Port Colborne, Stamford, St. Davids, and Niagara-on-the-Lake. The present development of these local transmission lines is over 160 miles of 3-phase circuits, not including lines owned by allied companies and customers; and this is constantly being extended, in order to meet the increasing demands of customers.

All of these transmission lines in Canada are owned by The Ontario Transmission Company, Limited, a subsidiary corporation, all of whose stock (except qualifying shares for Directors) is owned, and all of whose bonds are guaranteed, principal and interest, by The Ontario Power Company.

The Transmission Company owns in fee a right of way 300 feet in width from the Distributing Station to the Niagara Crossing, a similar right of way 35 to 50 feet in width from the Distributing Station to Welland, pole-right franchises on all highways in eight townships, covering an area of 385 square miles; and, in addition, 300 acres of land available for manufacturing sites.

POWER DISTRIBUTION

The Niagara, Lockport and Ontario Power Company distributes the power of The Ontario Power Company in the United States. Its lines form a network, having a length of about 816 miles, throughout western and central New York as far east as Syracuse, and the power so distributed operates a large number of enterprises throughout this district, including railways and trolley lines, steel plants, light, heat, and power companies, and electro-chemical and electro-metallurgical industries.

Under contracts with the Buffalo and Lake Erie Traction Company and the Niagara and Erie Power Company, the power is transmitted over existing 60,000-volt lines of these companies to Erie, Pa., 88 miles west of Buffalo.

The Ontario Distributing Company distributes the power of The Ontario Power Company in the townships of Stamford and Niagara, in the Province of Ontario. President, J. H. Symmes; Secretary-Treasurer, Robin Boyle; Office, Imperial Bank Chambers, Niagara Falls, Ontario.

The Hydro-Electric Power Commission is an official body

60,000-VOLT TRANSMISSION LINE — ONTARIO TRANSMISSION CO.

MAP OF TERRITORY, 500 MILES SURROUNDING NIAGARA FALLS.

created by the Legislature of Ontario for the purpose of distributing electric power throughout the Province of Ontario. It has entered into a long-term contract with The Ontario Power Company to purchase power at its Distributing Station. Its system of transmission lines, 1,050 miles in length, is now practically completed and it has already begun to transmit the power to the various municipalities within a distance of about 200 miles from Niagara.

WHAT THE POWER IS USED FOR

It is impossible to enumerate the manifold purposes for which the power is used, but some of the more important are the following:

LIGHT. The power generated at this station and sent out over the above named transmission lines furnishes part or all of the public and private lighting in Niagara Falls, Welland, Stamford, Port Colborne, and Merritton, Ontario; and Lockport, Depew, Lackawanna, Hamburg, Batavia, Rochester, Canandaigua, Auburn, Baldwinsville, Phœnix, Fulton, and Syracuse, New York.

HEAT. The same power operates electric furnaces for the reduction of iron, copper, and other ores, and the manufacture of cement, calcium carbide, lime nitrates, and abrasive materials, in Port Colborne, Welland, Niagara Falls, Thorold, and Chippawa, Ontario; and Lockport, New York.

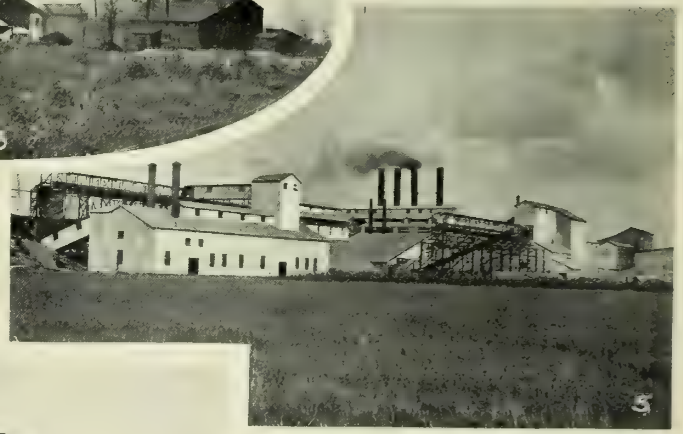
POWER. The same power operates in whole or in part the trolley systems in Syracuse, Rochester, Canandaigua, Geneva, Lackawanna, and Hamburg; and the interurban lines, Syracuse, Lake Shore & Northern, Syracuse & South Bay, Syracuse & Auburn, Rochester & Syracuse, Rochester & Geneva, Rochester & Mt. Morris (Erie Railroad), Buffalo, Lockport & Rochester, Buffalo & Hamburg, and Buffalo & Lake Erie. It operates the steel works of the Canadian Steel Foundries, Limited, at Welland, Lackawanna Steel Company (7,000 employes), plate rolling mills of Seneca Iron and Steel Company, and pumping works of Depew and Lake Erie Water Company at Lackawanna; repair shops of the New York Central & Hudson River Railroad Company, and Delaware, Lackawanna & Western Railroad Company, and works of Gould Coupler Company at Depew; stone-crushing establishment of the Kelley Island Lime and Transport Company at Akron, and of Empire Limestone Company at Pekin; works of the United States Gypsum Company at Oakfield; American Locomotive Company of Dunkirk; and various smaller industries located on main transmission lines. Through the distributing systems of the light, heat, and power companies in the various cities above named in Ontario and New York, this power is applied to practically every use for which power is utilized, from sewing machines and ventilating fans to rolling mills and trip hammers.

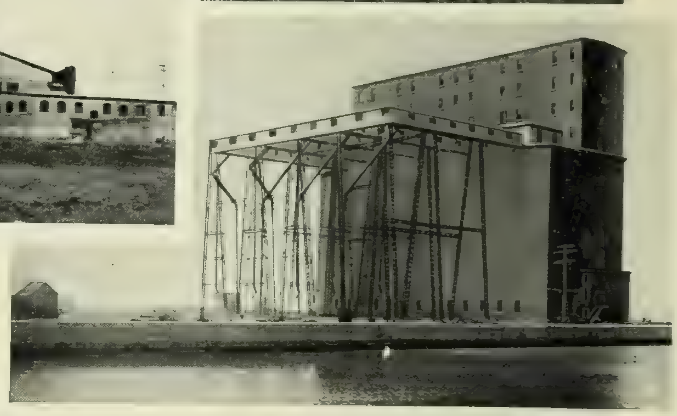
NIAGARA AS A MANUFACTURING CENTER

The utilization of a portion of the vast energy of Niagara, without in any way detracting from the splendor or beauty of the Falls, is destined to create in the Ontario peninsula and in Western New York a vast manufacturing district. This evolution is already in progress and every year it gains added strength. The cheapest power is to be had in the vicinity of the works, on both sides of the river, and as far as the Welland Canal on the west, and Lockport on the east. Within those limits there is abundance of cheap land for manufacturing sites, cheap power, and cheap transportation by the Welland or Erie canals or by any one of five trunk railroad lines. In this district will naturally be the home of the electro-furnaces, producing certain grades of metals and alloys, of fertilizers and other calcium products, which require power at so low a cost as to make long distance transmission impossible. Beyond this district and in the territory between Detroit on the west and Syracuse on the east, Toronto on the north, and Dunkirk on the south, there are power, cheap transportation, abundant labor, and proximity to a market of more than 40,000,000 people, all living within a night's ride of Niagara. All this territory shares in the benefits of the Great Lakes bringing cheap raw materials from the West, and of all the trunk lines of railroad between Chicago and the Atlantic Seaboard for distributing the finished products. These favorable conditions have already resulted in the establishment on the Niagara frontier of steel and iron industries second only to those of Pittsburgh, and of flouring mills which are a close rival to those of Minneapolis. In future years and as the electrification of the railroads progresses, these favorable conditions will make the Niagara District — on both sides of the International boundary — an unrivaled center of manufacturing industries.

CHRONOLOGY

Charter granted by Parliament of Dominion of Canada, June 23, 1887.
Charter acquired by present owners, April 9, 1900.
Ground broken for Generating Station, July 15, 1902.
Work on diverting dam—Dufferin Islands—started, August 15, 1902.
Units, Nos. 1, 2, and 3 in operation, July 1, 1905.
Power delivered commercially in Lockport, N. Y., Nov. 6, 1905.
Power delivered commercially in Syracuse, N. Y., July 7, 1906.
Unit No. 4 in operation, Nov. 5, 1906.
Power delivered commercially in Welland, Ont., Nov. 6, 1906.
Units 5 and 6 in operation, Jan. 18, 1908.
Unit 7 in operation, Sept. 10, 1909.
No. 2 Main Conduit in operation, August, 21, 1910.
Unit 8 in operation, Dec. 22, 1910.
Unit 9 in operation, April 12, 1911.
Unit 10 in operation, July 30, 1911.
Unit 11 in operation, March 3, 1913.
Unit 12 in operation, June 3, 1913.





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3—Electro Metals, Ltd., Welland
4—Canadian Ramapo Iron Works, Ltd., Stamford
5—Canada Cement Company, Port Colborne
6—Norton Company, Chippawa
7—Ontario Paper Co., Thorold
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9—American Cyanamid Company, Suspension Bridge
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